UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF
PREVENTION, PESTICIDES
AND TOXIC SUBSTANCES

Note to Reader

Background: As part of its effort to involve the public in the implementation of the Food Quality Protection Act of 1996 (FQPA), which is designed to ensure that the United States continues to have the safest and most abundant food supply. EPA is undertaking an effort to open public dockets on the organophosphate pesticides. These dockets will make available to all interested parties documents that were developed as part of the U.S. Environmental Protection Agency's process for making reregistration eligibility decisions and tolerance reassessments consistent with FQPA. The dockets include preliminary health assessments and, where available, ecological risk assessments conducted by EPA, rebuttals or corrections to the risk assessments submitted by chemical registrants, and the Agency's response to the registrants' submissions.

The analyses contained in this docket are preliminary in nature and represent the information available to EPA at the time they were prepared. Additional information may have been submitted to EPA which has not yet been incorporated into these analyses, and registrants or others may be developing relevant information. It's common and appropriate that new information and analyses will be used to revise and refine the evaluations contained in these dockets to make them more comprehensive and realistic. The Agency cautions against premature conclusions based on these preliminary assessments and against any use of information contained in these documents out of their full context. Throughout this process, If unacceptable risks are identified, EPA will act to reduce or eliminate the risks.

There is a 60 day comment period in which the public and all interested parties are invited to submit comments on the information in this docket. Comments should directly relate to this organophosphate and to the information and issues available in the information docket. Once the comment period closes, EPA will review all comments and revise the risk assessments, as necessary.

These preliminary risk assessments represent an early stage in the process by which EPA is evaluating the regulatory requirements applicable to existing pesticides. Through this opportunity for notice and comment, the Agency hopes to advance the openness and scientific soundness underpinning its decisions. This process is designed to assure that America continues to enjoy the safest and most abundant food supply. Through implementation of EPA's tolerance reassessment program under the Food Quality Protection Act, the food supply will become even safer. Leading health experts recommend that all people eat a wide variety of foods, including at least five servings of fruits and vegetables a day.

Note: This sheet is provided to help the reader understand how refined and developed the pesticide file is as of the date prepared, what if any changes have occurred recently, and what new information, if any, is expected to be included in the analysis before decisions are made. **It is not meant to be a summary of all current information regarding the chemical.** Rather, the sheet provides some context to better understand the substantive material in the docket (RED chapters, registrant rebuttals, Agency responses to rebuttals, etc.) for this pesticide.

Further, in some cases, differences may be noted between the RED chapters and the Agency's comprehensive reports on the hazard identification information and safety factors for all organophosphates. In these cases, information in the comprehensive reports is the most current and will, barring the submission of more data that the Agency finds useful, be used in the risk assessments.

Jack E. Housenger, Acting Director
Special Review and Reregistration Division

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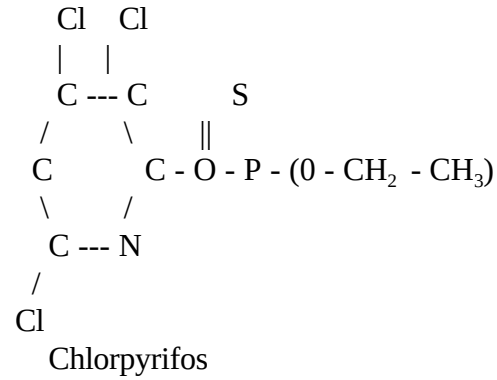
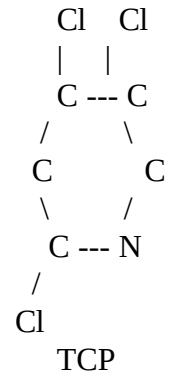
Appendix I. Chemical Structures for Chlorpyrifos and Its Major Degradate



Chlorpyrifos



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Appendix II. Terrestrial Fate Residue Model (Examples)

DAILY ACCUMULATED PESTICIDE RESIDUES — MULTIP. APPL. ON SHORT GRASS AT 1.0 LB AI./A

Chemical name ----------	CHLORPYRIFOS
Initial concentration (ppm) ----------	240
Half-life ----------	7
A number of application ----------	3
Application interval ----------	7
Length of simulated (day) ----------	36

DAY	RESIDUE (PPM)
0	240
1	217.3737
2	196.8805
3	178.3193
4	161.508
5	146.2816
6	132.4907
7	360
8	326.0605
9	295.3207
10	267.479
11	242.262
12	219.4225
13	198.7361
14	420
15	380.4039
16	344.5408
17	312.0588
18	282.6391
19	255.9929
20	231.8588
21	210
22	190.202
23	172.2704
24	156.0294
25	141.3195
26	127.9964
27	115.9294
28	105
29	95.10098
30	86.13519
31	78.01469
32	70.65975
33	63.99821
34	57.96469
35	52.5
36	47.55049
Maximum residue ----------	420
Average residue ----------	194.0622

DAILY ACCUMULATED PESTICIDE RESIDUES — MULTIP. APPL. ON FOLIAGE AT 1.0 LB AI/A

Chemical name ----------	CHLORPYRIFOS
Initial concentration (ppm) ----------	135
Half-life ----------	7
A number of application ----------	3
Application interval ----------	7
Length of simulated (day) ----------	36

DAY	RESIDUE (PPM)
0	135
1	122.2727
2	110.7453
3	100.3046
4	90.84825
5	82.28342
6	74.52604
7	202.5
8	183.409
9	166.1179
10	150.4569
11	136.2724
12	123.4251
13	111.7891
14	236.25
15	213.9772
16	193.8042
17	175.5331
18	158.9844
19	143.996
20	130.4206
21	118.125
22	106.9886
23	96.9021
24	87.76652
25	79.49222
26	71.99799
27	65.21028
28	59.0625
29	53.4943
30	48.45105
31	43.88327
32	39.74611
33	35.99899
34	32.60513
35	29.53125
36	26.74715

Maximum residue ----------	236.25
Average residue ----------	109.16

DAILY ACCUMULATED PESTICIDE RESIDUES — MULTIP. APPL. ON LONG GRASS AT 1.0 LB AI/A

Chemical name ----------	CHLORPYRIFOS
Initial concentration (ppm) ----------	110
Half-life ----------	7
A number of application ----------	3
Application interval ----------	7
Length of simulated (day) ----------	36

DAY	RESIDUE (PPM)
0	110
1	99.6296
2	90.23689
3	81.72969
4	74.02451
5	67.04575
6	60.72492
7	165
8	149.4444
9	135.3553
10	122.5945
11	111.0368
12	100.5686
13	91.08739
14	192.5
15	174.3518
16	157.9146
17	143.027
18	129.5429
19	117.3301
20	106.2686
21	96.2539
22	87.17589
23	78.95726
24	71.51346
25	64.77144
26	58.66503
27	53.1343
28	48.125
29	43.58795
30	39.47863
31	35.75673
32	32.38572
33	29.33251
34	26.56715
35	24.0625
36	21.79397
Maximum residue ----------	192.5
Average residue ----------	88.94514

DAILY ACCUMULATED PESTICIDE RESIDUES — MULTIP. APPL. ON FRUIT & SEEDS AT 1 LB AI/A

Chemical name ----------	CHLORPYRIFOS
Initial concentration (ppm) ----------	15
Half-life ----------	7
A number of application ----------	3
Application interval ----------	7
Length of simulated (day) ----------	36

DAY	RESIDUE (PPM)
0	15
1	13.58586
2	12.30503
3	11.14496
4	10.09425
5	9.142602
6	8.280671
7	22.5
8	20.37878
9	18.45745
10	16.71744
11	15.14138
12	13.7139
13	12.42101
14	26.25
15	23.77525
16	21.5338
17	19.50367
18	17.66494
19	15.99955
20	14.49117
21	13.125
22	11.88762
23	10.7669
24	9.75183
25	8.83247
26	7.999777
27	7.245587
28	6.5625
29	5.943812
30	5.38345
31	4.875918
32	4.416235
33	3.999888
34	3.622793
35	3.28125
36	2.971905

Maximum residue ----------	26.25
Average residue ----------	12.12888

DAILY ACCUMULATED PESTICIDE RESIDUES — MULTIP. APPL. ON SHORT GRASS AT 2 LBS AI/A

Chemical name ----------	CHLORPYRIFOS
Initial concentration (ppm) ----------	480
Half-life ----------	7
A number of application ----------	3
Application interval ----------	7
Length of simulated (day) ----------	35

DAY	RESIDUE (PPM)
0	480
1	434.7474
2	393.761
3	356.6387
4	323.016
5	292.5633
6	264.9815
7	720
8	652.121
9	590.6415
10	534.958
11	484.5241
12	438.8449
13	397.4722
14	840
15	760.8079
16	689.0817
17	624.1176
18	565.2781
19	511.9857
20	463.7176
21	420.4039
22	380.4039
23	344.5408
24	312.0588
25	282.6391
26	255.9929
27	231.8588
28	210
29	190.202
30	172.2704
31	156.0294
32	141.3195
33	127.9964
34	115.9294
35	105

Maximum residue ----------	840
Average residue ----------	396.2638

APPENDIX III. AQUATIC EECs – PRZM-EXAMS (Documentation) and GENEEC Model (Examples)

CHLORPYRIFOS

EEC Summary Sheet

Crop	Rate (lbs/ac)	No. Appls.	Interval (days)	Peak (ppb)	96 Hours (ppb)	21 Day (ppb)	60 Day (ppb)	90 Day (ppb)
Corn IA	3.0	1	N/A	11.1	8.7	4.5	2.7	1.9
Corn Clust. (IA)	1.3	1	N/A	4.0	3.1	1.6	1.0	0.7
Corn Clust. (MS)	1.3	1	N/A	4.6	3.7	1.9	1.1	0.7
Corn Foliar (FL-GA)	1.0	11	3	15.8	12.8	7.4	5.6	4.3
Peanuts GA	2.0	2	40	15.4	11.5	6.0	3.6	2.7
Cotton MS	1.0	6	3	14.0	10.8	5.7	3.7	3.0
Tobacco NC	5.0	1	N/A	40.6	31.0	14.7	7.7	5.4
Citrus FL	3.5	2	30	27.6	21.4	11.8	8.3	6.7

SCENARIO SUMMARY FOR CORN

This report describes the Tier II estimated environmental concentration (EEC) computer modelling for Chlorpyrifos use on corn. The purpose of this analysis is to generate an aquatic exposure estimates for use in a refined ecological risk assessment for this chemical. This Tier II EEC calculation uses a single Iowa site which represents a high yet typical exposure scenario for the use of Chlorpyrifos. The more extreme sites in southern states are believed to be well above the 90th percentile in terms of severity. In furrow applications with two inch incorporation is simulated. The weather and agricultural practice are simulated at the site over 36 years so that the ten year exceedence probability EEC at that site can be estimated.

The EEC's generated in this analysis were calculated using PRZM2 for simulating runoff from the agricultural field and EXAMS 2.94 for estimating environmental fate and transport in surface water. Input values for both programs are attached to this report in Tables 1 and 2. The scenario chosen was a corn field in Pottawottamie County, Iowa. The modelling predicts an annual total of 4.5 inches of runoff or approximately 12 percent of rainfall. This Marshall silty clay loam soil is a B hydrologic group soil which would be expected to produce moderate runoff and erosion. Sites exist which would represent a worse case for corn (ie Mississippi) which would lead to higher EEC values (possibly by a factor of 2 to 3). Due to the great prevalence of corn in the Mid-West, however, these sites would be outside the 90% worst case sites we normally model and so are not considered here. A copy of the PRZM2 input file is attached.

The EXAMS II receiving water program was used to simulate the fate and transport of Chlorpyrifos in the standard static pond. Calculations were made for one application on May 14 each year as is typical practice in this area. The Tier 2 one in ten year EEC's are graphed and listed below. The EEC's have been calculated so that in any given year, there is a 10% probability that the maximum of the average concentrations for each duration in that year will equal or exceed the EEC at the site.

Scenarios

The scenario chosen was used to represent a typical to high runoff site for chlorpyrifos applied on corn. The site represents a 10 hectare corn field draining into a 1 hectare static pond, 2 meters deep with no outlet. It is assumed that evaporation losses and inflow from rainfall and runoff are in balance.

The site is a field in MLRA 107. Data for the Marshall Silty Clay Loam was taken from the PIC database and the 1987 National Resources Inventory. This is hydrologic group B soil and SCS curve numbers were generated based on this grouping. USLE soil loss ratios are based on plant cover and USDA Paper 537 (United States Soil Conservation Service, 1972). Weather data was taken from weather station W14943 in Sioux City, IA. The weather data file is part of the PIRANHA shell and is used to represent the weather for all of MLRA 107. This site receives about 87 centimeters of precipitation yearly and an average of 12% of this leaving the field as

runoff.

Environmental Fate Inputs

Environmental fate inputs to the PRZM and EXAMS programs are listed along with their sources in Tables 1 and 2 attached. All chemical specific inputs are derived from environmental fate studies sumbitted by the registrant and accepted by EPA.

Results

Modelling results are shown on the attached graphs and spreadsheet tables and are include in the EEC Modelling Summary sheet below.

Limitations of this Analysis

There are several factors which limit the accuracy and precision of this analysis including the selection of the high exposure scenarios, the quality of the input data, the ability of the models to represent the real world, and the number of years that were modeled.

Scenarios that are selected for use in Tier 2 EEC calculations are ones that likely to produce large concentrations in the aquatic environment. Each scenario should represent a real site to which the pesticide in question is likely to be applied. Sites should be extreme enough to provide conservative estimates of the EEC, but not so extreme that the model cannot properly simulate the fate and transport processes at the site. Currently, sites are chosen by best professional judgement to represent sites which generally produce EEC's larger than 90% of all sites use for that crop. In this modelling, a more typical site was run because the higher exposure sites (ie. Mississippi) are beyond the ninetieth percentile due to the predominance of corn in the midwest. The EEC's in this analysis are accurate only to the extent that the site represents this hypothetical site. Another limiting part of the site selection is the use of the standard pond with no outlet. Obviously, a Georgia pond, even with appropriately modified temperature data is not the most appropriate water body for use in Iowa. It does however provide a level playing field on which most pesticides can be judged on equal terms.

The models themselves represent a limitation on the analysis quality. While the models are some of the best environmental fate estimation tools available, they have significant limitations in their ability to represent some processes. The most substantial limitation in this analysis is the handling of spray drift, which is estimated as a straight 5% of the application rate reaching the pond for each application. A second major limitation of the models is the lack of validation at the field level for pesticide runoff. While several of the algorithms (volume of runoff water, eroded sediment mass, are well validated and well understood, no adequate validation has yet been made of PRZM2 for the amount of pesticide transported in runoff events for all combinations of sites and pesticide fate characterists. Other limitations of the models include: inability to handle within site variation (spatial variability), lack of crop growth algorithms, and overly simple soil water

transport algorithms (ie. the "tipping bucket" method).

A final limitation is that only thirty-six years of weather data was available for the site. Consequently there is approximately 1 chance in 20 that the true 10% exceedence EEC's are larger than the maximum EEC in the calculated in the analysis.

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*** PRZM2 Data File ***
*** GACORN.INP FEBRUARY 8, 1995 ***
*** Assume 4% slope, conventional tillage with crop residue left on the field after harvest***
Chlorpyrifos
Cowarts sandy loam; MLRA P-133A, Crips County, Georgia
  0.750   0.150       0   17.00       1       3
     1
   0.24    0.33    0.50   10.00    5.80
     1
     1    0.25   90.00  100.00       3  91  85  88 .50 .25 .30    0.00
    36
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110480 280880 120980 1
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110483 280883 120983 1
Application Schedule: 11 aerial spray apps of 1.0 lb a.i/a, 75% app eff, 5% spray drift
396 1 0
Chlorpyrifos Koc:6070 AeSM: T1/2=76.93 (62.09) days, AnSM: T1/2=15 days
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070848 0 0.0 0.842
100848 0 0.0 0.842
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160848 0 0.0 0.842
190848 0 0.0 0.842
220848 0 0.0 0.842
250848 0 0.0 0.842
280848 0 0.0 0.842
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160849 0 0.0 0.842
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250865	0	0.0	0.842
280865	0	0.0	0.842
310865	0	0.0	0.842
030965	0	0.0	0.842
040866	0	0.0	0.842
070866	0	0.0	0.842
100866	0	0.0	0.842
130866	0	0.0	0.842
160866	0	0.0	0.842
190866	0	0.0	0.842
220866	0	0.0	0.842
250866	0	0.0	0.842
280866	0	0.0	0.842
310866	0	0.0	0.842
030966	0	0.0	0.842
040867	0	0.0	0.842
070867	0	0.0	0.842
100867	0	0.0	0.842
130867	0	0.0	0.842

160867	0	0.0	0.842
190867	0	0.0	0.842
220867	0	0.0	0.842
250867	0	0.0	0.842
280867	0	0.0	0.842
310867	0	0.0	0.842
030967	0	0.0	0.842
040868	0	0.0	0.842
070868	0	0.0	0.842
100868	0	0.0	0.842
130868	0	0.0	0.842
160868	0	0.0	0.842
190868	0	0.0	0.842
220868	0	0.0	0.842
250868	0	0.0	0.842
280868	0	0.0	0.842
310868	0	0.0	0.842
030968	0	0.0	0.842
040869	0	0.0	0.842
070869	0	0.0	0.842
100869	0	0.0	0.842
130869	0	0.0	0.842
160869	0	0.0	0.842
190869	0	0.0	0.842
220869	0	0.0	0.842
250869	0	0.0	0.842
280869	0	0.0	0.842
310869	0	0.0	0.842
030969	0	0.0	0.842
040870	0	0.0	0.842
070870	0	0.0	0.842
100870	0	0.0	0.842
130870	0	0.0	0.842
160870	0	0.0	0.842
190870	0	0.0	0.842
220870	0	0.0	0.842
250870	0	0.0	0.842
280870	0	0.0	0.842
310870	0	0.0	0.842
030970	0	0.0	0.842
040871	0	0.0	0.842
070871	0	0.0	0.842
100871	0	0.0	0.842
130871	0	0.0	0.842
160871	0	0.0	0.842

190871	0	0.0	0.842
220871	0	0.0	0.842
250871	0	0.0	0.842
280871	0	0.0	0.842
310871	0	0.0	0.842
030971	0	0.0	0.842
040872	0	0.0	0.842
070872	0	0.0	0.842
100872	0	0.0	0.842
130872	0	0.0	0.842
160872	0	0.0	0.842
190872	0	0.0	0.842
220872	0	0.0	0.842
250872	0	0.0	0.842
280872	0	0.0	0.842
310872	0	0.0	0.842
030972	0	0.0	0.842
040873	0	0.0	0.842
070873	0	0.0	0.842
100873	0	0.0	0.842
130873	0	0.0	0.842
160873	0	0.0	0.842
190873	0	0.0	0.842
220873	0	0.0	0.842
250873	0	0.0	0.842
280873	0	0.0	0.842
310873	0	0.0	0.842
030973	0	0.0	0.842
040874	0	0.0	0.842
070874	0	0.0	0.842
100874	0	0.0	0.842
130874	0	0.0	0.842
160874	0	0.0	0.842
190874	0	0.0	0.842
220874	0	0.0	0.842
250874	0	0.0	0.842
280874	0	0.0	0.842
310874	0	0.0	0.842
030974	0	0.0	0.842
040875	0	0.0	0.842
070875	0	0.0	0.842
100875	0	0.0	0.842
130875	0	0.0	0.842
160875	0	0.0	0.842
190875	0	0.0	0.842

220875	0	0.0	0.842
250875	0	0.0	0.842
280875	0	0.0	0.842
310875	0	0.0	0.842
030975	0	0.0	0.842
040876	0	0.0	0.842
070876	0	0.0	0.842
100876	0	0.0	0.842
130876	0	0.0	0.842
160876	0	0.0	0.842
190876	0	0.0	0.842
220876	0	0.0	0.842
250876	0	0.0	0.842
280876	0	0.0	0.842
310876	0	0.0	0.842
030976	0	0.0	0.842
040877	0	0.0	0.842
070877	0	0.0	0.842
100877	0	0.0	0.842
130877	0	0.0	0.842
160877	0	0.0	0.842
190877	0	0.0	0.842
220877	0	0.0	0.842
250877	0	0.0	0.842
280877	0	0.0	0.842
310877	0	0.0	0.842
030977	0	0.0	0.842
040878	0	0.0	0.842
070878	0	0.0	0.842
100878	0	0.0	0.842
130878	0	0.0	0.842
160878	0	0.0	0.842
190878	0	0.0	0.842
220878	0	0.0	0.842
250878	0	0.0	0.842
280878	0	0.0	0.842
310878	0	0.0	0.842
030978	0	0.0	0.842
040879	0	0.0	0.842
070879	0	0.0	0.842
100879	0	0.0	0.842
130879	0	0.0	0.842
160879	0	0.0	0.842
190879	0	0.0	0.842
220879	0	0.0	0.842

250879	0	0.0	0.842
280879	0	0.0	0.842
310879	0	0.0	0.842
030979	0	0.0	0.842
040880	0	0.0	0.842
070880	0	0.0	0.842
100880	0	0.0	0.842
130880	0	0.0	0.842
160880	0	0.0	0.842
190880	0	0.0	0.842
220880	0	0.0	0.842
250880	0	0.0	0.842
280880	0	0.0	0.842
310880	0	0.0	0.842
030980	0	0.0	0.842
040881	0	0.0	0.842
070881	0	0.0	0.842
100881	0	0.0	0.842
130881	0	0.0	0.842
160881	0	0.0	0.842
190881	0	0.0	0.842
220881	0	0.0	0.842
250881	0	0.0	0.842
280881	0	0.0	0.842
310881	0	0.0	0.842
030981	0	0.0	0.842
040882	0	0.0	0.842
070882	0	0.0	0.842
100882	0	0.0	0.842
130882	0	0.0	0.842
160882	0	0.0	0.842
190882	0	0.0	0.842
220882	0	0.0	0.842
250882	0	0.0	0.842
280882	0	0.0	0.842
310882	0	0.0	0.842
030982	0	0.0	0.842
040883	0	0.0	0.842
070883	0	0.0	0.842
100883	0	0.0	0.842
130883	0	0.0	0.842
160883	0	0.0	0.842
190883	0	0.0	0.842
220883	0	0.0	0.842
250883	0	0.0	0.842

```
 280883       0     0.0   0.842
 310883       0     0.0   0.842
 030983       0     0.0   0.842
    2       3     0.0
  0.0   0.693     0.5
Cowarts sandy loam; Hydrologic Group C;
 100.00     0.0   0   0   0   0   0   0   0   0   0
 0.0E00  0.0E00  0.0E00
    2
    1   10.00   1.650   0.125   0.000   0.000
      9.01e-3 9.01e-3   0.000
        0.10   0.125   0.045   0.580   35.21
    2   90.00   1.500   0.244   0.000   0.000
      0.0460  0.0460   0.000
        2.0   0.244   0.144   0.174   10.56
    0       0
       YEAR      5          YEAR      5          YEAR      5   1
    5    YEAR
  RFLX    TSER        1.0E+05
  EFLX    TSER        1.0E+05
  ESLS    TSER        1.0E+00
  RUNF    TSER        1.0E+00
  PRCP    TSER        1.0E+00
```

SITES/SCENARIOS FOR PEANUTS

This report describes the Tier II estimated environmental concentration (EEC) computer modelling for chlorpyrifos use on peanuts. The purpose of this analysis is to generate an aquatic exposure estimates for use in a refined ecological risk assessment for this chemical. This Tier II EEC calculation uses a single site which represents a high exposure scenario for the use of Chlorpyrifos. It employs the standard scenario which represents a 10 hectare field draining into a 1 hectare pond, 2 m deep with no outlet. The weather and agricultural practice are simulated at the site over 36 years so that the ten year exceedence probability EEC at that site can be estimated. The EEC's generated in this analysis were calculated using PRZM2 for simulating runoff from the agricultural field and EXAMS 2.94 for estimating environmental fate and transport in surface water.

The site is a peanut field in Cripps county, Georgia in MLRA 153A. The soil at the site is a Tifton loamy sand. Soil parameters were taken from the PIC database and the 1987 National Resources Inventory. The Tifton loamy sand is hydrologic group C soil and SCS curve numbers were generated based on this grouping and the plant cover (United States Soil Conservation Service, 1972). The weather data file is part of the PIRANHA shell and is used to represent the weather for MLRA 153A.

The parameters used in PRZM2 to describe the scenario are tabulated in Table 1 attached. The chemical and environment parameters used in the EXAMS program are tabulated in Table 2 also attached to this report. The site were selected to represent peanut sites in the south-eastern United States that are likely to present high exposure to aquatic organisms.

Procedure

The PRZM simulation was run for a period of 36 years from 1948 to 1983 with application of the pesticide twice per year at the label rate of 2.0 pounds per acre of active ingredient for each application. EXAMS loading (PRZM2EXA) files were developed to have 5% of each application rate applied to the pond as spray drift. EXAMS was run for all 36 years in mode 3. The yearly maxima, largest yearly peaks, maximum 96-hour means and largest yearly 21-day means were extracted from the REPORT.XMS file produced by EXAMS. The largest yearly 60- and 90-day means were calculated by PEO from daily concentration values generated by EXAMS. The 10 year return EEC's (or 10% yearly exceedence EEC's) show on the graphs and listed in the attached Tables were calculated by linear interpolation between the third and fourth largest values. Input files for these analyses are also attached to the end of this report.

Limitations of this Analysis

There are several factors which limit the accuracy and precision of this analysis including the selection of the high exposure scenarios, the quality of the input data, the ability of the models to represent the real world, and the number of years that were modeled.

Scenarios that are selected for use in Tier 2 EEC calculations are ones that likely to

produce relatively high concentrations in the aquatic environment. Each scenario should represent a real site to which the pesticide in question is likely to be applied. Sites should be extreme enough to provide conservative estimates of the EEC, but not so extreme that the model cannot properly simulate the fate and transport processes at the site. Currently, sites are chosen by best professional judgement to represent sites which generally produce EEC's larger than 90% of all sites use for that crop. The EEC's in this analysis are accurate only to the extent that the site represents this hypothetical high exposure site. Another potentially limiting part of the site selection is the use of the standard pond with no outlet. A single Georgia pond may not be a good representation of all water bodies in the state. It does, however, give a conservative estimate of an estimated environmental concentration (EEC) in a water body that serves as a surrogate for all sensitive water bodies and provides a level playing field on which most pesticides can be judged on equal terms.

The models themselves represent a limitation on the analysis quality. While the models are some of the best environmental fate estimation tools available, they have significant limitations in their ability to represent some processes. The most substantial limitation in this analysis is the handling of spray drift, which is estimated as a straight 5% of the application rate reaching the pond for each application. A second major limitation of the models is the lack of validation at the field level for pesticide runoff. While several of the algorithms (volume of runoff water, eroded sediment mass, are well validated and well understood, no adequate validation has yet been made of PRZM2 for the amount of pesticide transported in runoff events for all combinations of sites and pesticide fate characteristics. Other limitations of the models include: inability to handle within site variation (spatial variability), lack of crop growth algorithms, and overly simple soil water transport algorithms (ie. the "tipping bucket" method).

A final limitation is that only thirty-six years of weather data was available for the site. Consequently there is approximately 1 chance in 20 that the true 10% exceedence EEC's are larger than the maximum EEC in the calculated in the analysis.

```
*** PRZM2 Version 2.3 Input Data File ***
*** GAPEANUT.INP January 5, 1995 ***
*** Assume 4% slope, conventional tillage with crop residue left on the field after harvest***
Chlorpyrifos
Tifton Loamy Sand; MLRA P-153A, Coffee County, GA
  0.750   0.150       0   30.00       1       3
     1
   0.17    0.54    0.50   10.00    7.30
     1
     1    0.10   45.00   80.00       3  86  78  82 .46 .45 .46    0.00
    36
 010548  160948  011048       1
 010549  160949  011049       1
 010550  160950  011050       1
 010551  160951  011051       1
 010552  160952  011052       1
```

010553 160953 011053 1
010554 160954 011054 1
010555 160955 011055 1
010556 160956 011056 1
010557 160957 011057 1
010558 160958 011058 1
010559 160959 011059 1
010560 160960 011060 1
010561 160961 011061 1
010562 160962 011062 1
010563 160963 011063 1
010564 160964 011064 1
010565 160965 011065 1
010566 160966 011066 1
010567 160967 011067 1
010568 160968 011068 1
010569 160969 011069 1
010570 160970 011070 1
010571 160971 011071 1
010572 160972 011072 1
010573 160973 011073 1
010574 160974 011074 1
010575 160975 011075 1
010576 160976 011076 1
010577 160977 011077 1
010578 160978 011078 1
010579 160979 011079 1
010580 160980 011080 1
010581 160981 011081 1
010582 160982 011082 1
010583 160983 011083 1
Application Schedule: 2 ground applications of 2.0 lb a.i/a, 1 % spray drift
72 1 0
Chlorpyrifos Koc:6070 AeSM: T1/2=76.93 (62.09) days, AnSM: T1/2=15 days
200448 0 5.08 2.134
010648 0 0.0 2.134
200449 0 5.08 2.134
010649 0 0.0 2.134
200450 0 5.08 2.134
010650 0 0.0 2.134
200451 0 5.08 2.134
010651 0 0.0 2.134
200452 0 5.08 2.134
010652 0 0.0 2.134
200453 0 5.08 2.134

010653 0 0.0 2.134
200454 0 5.08 2.134
010654 0 0.0 2.134
200455 0 5.08 2.134
010655 0 0.0 2.134
200456 0 5.08 2.134
010656 0 0.0 2.134
200457 0 5.08 2.134
010657 0 0.0 2.134
200458 0 5.08 2.134
010658 0 0.0 2.134
200459 0 5.08 2.134
010659 0 0.0 2.134
200460 0 5.08 2.134
010660 0 0.0 2.134
200461 0 5.08 2.134
010661 0 0.0 2.134
200462 0 5.08 2.134
010662 0 0.0 2.134
200463 0 5.08 2.134
010663 0 0.0 2.134
200464 0 5.08 2.134
010664 0 0.0 2.134
200465 0 5.08 2.134
010665 0 0.0 2.134
200466 0 5.08 2.134
010666 0 0.0 2.134
200467 0 5.08 2.134
010667 0 0.0 2.134
200468 0 5.08 2.134
010668 0 0.0 2.134
200469 0 5.08 2.134
010669 0 0.0 2.134
200470 0 5.08 2.134
010670 0 0.0 2.134
200471 0 5.08 2.134
010671 0 0.0 2.134
200472 0 5.08 2.134
010672 0 0.0 2.134
200473 0 5.08 2.134
010673 0 0.0 2.134
200474 0 5.08 2.134
010674 0 0.0 2.134
200475 0 5.08 2.134
010675 0 0.0 2.134

```
 200476       0    5.08   2.134
 010676       0     0.0   2.134
 200477       0    5.08   2.134
 010677       0     0.0   2.134
 200478       0    5.08   2.134
 010678       0     0.0   2.134
 200479       0    5.08   2.134
 010679       0     0.0   2.134
 200480       0    5.08   2.134
 010680       0     0.0   2.134
 200481       0    5.08   2.134
 010681       0     0.0   2.134
 200482       0    5.08   2.134
 010682       0     0.0   2.134
 200483       0    5.08   2.134
 010683       0     0.0   2.134
    2       3     0.0
  0.0   0.139     0.5
Tifton Loamy Sand; Hydrologic Group C;
 150.00     0.0   0   0   0   0   0   0   0   0   0
   0.0 4.21E-6    0.00
     3
     1   10.00   1.300   0.160   0.000   0.000
      9.01E-3 9.01E-3   0.000
         0.1   0.160   0.080   0.580    35.2
     2   15.00   1.300   0.160   0.000   0.000
      9.01E-3 9.01E-3   0.000
         1.0   0.160   0.080   0.580    35.2
     3  125.00   1.600   0.317   0.000   0.000
       0.0460  0.0460   0.000
         5.0   0.317   0.197   0.174    10.6
     0       0
        YEAR      5          YEAR      5          YEAR      5   1
     5   YEAR
  RFLX    TSER        1.0E+05
  EFLX    TSER        1.0E+05
  ESLS    TSER        1.0E+00
  RUNF    TSER        1.0E+00
  PRCP    TSER        1.0E+00
```

SITES/SCENARIOS FOR COTTON

This report describes the Tier II estimated environmental concentration (EEC) computer modelling for chlorpyrifos use on cotton. The purpose of this analysis is to generate aquatic exposure estimates for use in a refined ecological risk assessment for this chemical. This Tier II EEC calculation uses a single cotton site which represents a high exposure scenario for the use of chlorpyrifos on this crop. It uses the standard scenario which represents a 10 hectare field draining into a 1 hectare pond, 2 meters deep with no outlet. Evaporation from the pond is considered to be equal in magnitude to inflow into the pond from surface runoff.

The cotton growing area chosen for this computer simulation is Yazoo County, Mississippi. This is an area in the heart of the south-central cotton growing region and provides a site which contains a highly erodible soil and an very erosive rainfall. It is therefore ideal for modeling pesticides which move off of the site dissolved in runoff water or are strongly adsorbed to eroded soil or are a combination of each as in the case of chlorpyrifos. All cotton cultural practices represented are those legal under the conservation compliance section of the Food Security Act.

The weather and agricultural practices are modelled at the site over 36 years so that the ten year exceedence probability EEC at that site can be estimated. Weather for the PRZM2 simulations is thirty-six years of actual data for NOAA Weather Station W03940 in Jackson, MS as developed for MLRA 134 for the PRZM program. Average rainfall is 50.0 inches per year. A total of 29.4 percent of this becomes runoff in this simulation.

The Tier 2 one in ten year return period EEC's are graphed and listed below. The EEC's have been calculated so that in any given year, there is a 10% probability that the maximum of the average concentrations for each duration in that year will equal or exceed the EEC at the site. Durations for which average concentrations are calculated are those which correspond to the length of relevant toxicity tests.

The EEC's generated in this analysis were calculated using PRZM2 for simulating runoff from the agricultural field and EXAMS 2.94 for estimating environmental fate and transport in surface water. The parameters used in PRZM2 to describe the scenario are tabulated in Table 1 attached. The chemical and environment parameters used in the EXAMS program are tabulated in Table 2 also attached to this report. Copies of the PRZM2 input files are also attached.

This simulation attempts to model cotton culture in the hill area of the county. Approximately forty percent of Yazoo county agricultural area is in the Delta region and the other sixty percent is in the hill region. Roughly 100,000 acres in the hill area is planted in cotton. Slopes in the hill area range from two to six percent. Slope lengths as used in the Universal Soil Loss Equation (USLE) vary from 75-150 feet.

The best cotton soil in the hill region of Yazoo county, Morganfield silt loam, is very restricted in area. The most common soil in the hill area of the county is the Loring silt loam and is used in this simulation. It is a very highly erodible soil with a USLE K value of 0.49 and has a

fragipan at a depth of about two feet. Soil characteristics are estimated by the PIC input file facility for PRZM for the Loring silt loam.

Cotton culture is restricted by the provisions of the conservation compliance portion of the Food Security Act. Loring silt loam has a tolerance (T) of three tons of soil loss per acre per year. The Act limits soil loss for cotton to 4T (four times the tolerance value). Cotton farmers on Loring soil therefore are held to a long term average soil loss of 12 tons per acre per year based on USLE calculations. Farmers achieve this limit of soil loss either through conventional practices with terracing (75%) or through a no-till scheme (6% and growing rapidly). One common scheme is a rotation including two years of no-till followed by one year of conventional cotton during which time the beds are rebuilt. The latter scheme is the one modelled in this simulation because it provides the worst legal case for soil erosion occurring one out of every three years.

The conservation compliance farm plan which is likely to provide the least protection for aquatic resources is the rotation of one year of conventional tillage with two years of no-till. Heavier runoff and soil erosion are likely during the years in which the conventional tillage is practiced. USDA runoff experiments on Loring soils in Mississippi show a water yield of 27 percent from no-till soybeans and 35 percent from conventional soybeans. A rotation of one year of conventional cotton followed by two years of no-till is modeled in this exercise.

When the PRZM2 model is run with curve numbers chosen from standard tables for row crops under this scenario, the runoff volume is very small compared to the actual runoff volume expected from USDA runoff studies conducted on this soil. The models were therefore calibrated by raising the curve numbers to give a longterm average runoff of 30 percent of rainfall.

Soil loss ratios (USLE C values) were developed with the Revised Universal Soil Loss Equation (RUSLE) computer model. The scenario assumes moderate crop residues remain on the field after harvest and that weeds which normally grow in the cotton fields in winter are not removed and therefore provide protection against erosion during that period. Weeds are typically killed with herbicide (Lindane or Roundup) just prior to planting.

Application of Chlorpyrifos® to cotton in the hill area of Yazoo County is by ground or by aerial application. USDA field tests for cotton in the area show that 75 to 90 percent of the chemical applied is actually deposited on the cotton plant. Modelling with PRZM2 assumed an overall 75 percent application efficiency. This is modeled in PRZM2 by reducing the application rate to 75 percent of the label rate.

Procedure

The PRZM simulation was run for a period of 36 years from 1948 to 1983 with application of the pesticide six times per year. EXAMS loading (PRZM2EXA) files were developed to have 5% of each application rate applied to the pond as spray drift. EXAMS was run for all 36 years in mode 3. The yearly maximums, largest yearly peaks, maximum 96-hour means and largest yearly 21-day means were extracted from the REPORT.XMS file produced by EXAMS. The largest yearly 60- and 90-day means were calculated by the PEO program from

daily concentration values generated by EXAMS. The 10 year return EEC's (or 10% yearly exceedence EEC's) are shown on attached graphs and are listed in attached tables. They were calculated by linear interpolation between the third and fourth largest values.

Limitations of this Analysis

There are several factors which may limit the accuracy and precision of this analysis including the selection of the high exposure scenarios, the quality of the input data, the ability of the models to represent the real world, and the number of years that were modeled.

Scenarios that are selected for use in Tier 2 EEC calculations are ones that likely to produce large concentrations in the aquatic environment. Each scenario should represent a real site to which the pesticide in question is likely to be applied. Sites should be extreme enough to provide conservative estimates of the EEC, but not so extreme that the model cannot properly simulate the fate and transport processes at the site. Currently, sites are chosen by best professional judgement to represent sites which generally produce EEC's larger than 90% of all sites use for that crop. The EEC's in this analysis are accurate to the extent that the site represents this hypothetical high exposure site. Another potentially limiting aspect of the analysis is the use of the standard Georgia pond which may or may not be an adequate representation of a Mississippi pond.

The models themselves may also represent a limitation on the accuracy of the analysis. While the models are some of the best environmental fate estimation tools available, they have significant limitations in their ability to represent some processes. The most substantial limitation in this analysis is the handling of spray drift, which is estimated as a straight 5% of the application rate reaching the pond for each application. A second major limitation of the models is the lack of validation at the field level for pesticide runoff. While several of the algorithms (volume of runoff water, eroded sediment mass, are well validated and well understood, no adequate validation has yet been made of PRZM2 for the amount of pesticide transported in runoff events for all combinations of sites and pesticide fate characteristics. Other limitations of the models include: inability to handle within site variation (spatial variability), lack of crop growth algorithms, and overly simple soil water transport algorithms (ie. the "tipping bucket" method).

A final limitation is that only thirty-six years of weather data was available for the site. Consequently there is approximately 1 chance in 20 that the true 10% exceedence EEC's are larger than the maximum EEC in the calculated in the analysis.

```
*** PRZM2 Version 2.3 Input Data File ***
*** MSCOTT2.INP January 23, 1997 ***
*** Assume 3 Year rotation w/one year conventional tillage & 2 years no-till
Chlorpyrifos
Loring silt loam; MLRA P-134, Jackson County, Mississippi, Cotton
  0.750   0.150       0   17.00       1       3
     1
   0.49    0.40    0.75   10.00    5.80
     3
     1   0.20  125.00   98.00       3  99  93  92 .63 .16 .18    0.00
     2   0.20  125.00   98.00       3  94  84  83 .16 .13 .13    0.00
     3   0.20  125.00   98.00       3  94  84  83 .16 .12 .09    0.00
    36
 010548  070948  220948       1
 010549  070949  220949       2
 010550  070950  220950       3
 010551  070951  220951       1
 010552  070952  220952       2
 010553  070953  220953       3
 010554  070954  220954       1
 010555  070955  220955       2
 010556  070956  220956       3
 010557  070957  220957       1
 010558  070958  220958       2
 010559  070959  220959       3
 010560  070960  220960       1
 010561  070961  220961       2
 010562  070962  220962       3
 010563  070963  220963       1
 010564  070964  220964       2
 010565  070965  220965       3
 010566  070966  220966       1
 010567  070967  220967       2
 010568  070968  220968       3
 010569  070969  220969       1
 010570  070970  220970       2
 010571  070971  220971       3
 010572  070972  220972       1
 010573  070973  220973       2
 010574  070974  220974       3
 010575  070975  220975       1
 010576  070976  220976       2
 010577  070977  220977       3
 010578  070978  220978       1
 010579  070979  220979       2
```

```
 010580  070980  220980       3
 010581  070981  220981       1
 010582  070982  220982       2
 010583  070983  220983       3
Application Schedule: 1 aerial apps of 0.50 lb a.i/a, @ 75% eff. w/5% drift
     36       1       0
Chlorpyrifos Koc:6070 AeSM: T1/2=30 days
  070848       0    0.00   0.421
  070849       0    0.00   0.421
  070850       0    0.00   0.421
  070851       0    0.00   0.421
  070852       0    0.00   0.421
  070853       0    0.00   0.421
  070854       0    0.00   0.421
  070855       0    0.00   0.421
  070856       0    0.00   0.421
  070857       0    0.00   0.421
  070858       0    0.00   0.421
  070859       0    0.00   0.421
  070860       0    0.00   0.421
  070861       0    0.00   0.421
  070862       0    0.00   0.421
  070863       0    0.00   0.421
  070864       0    0.00   0.421
  070865       0    0.00   0.421
  070866       0    0.00   0.421
  070867       0    0.00   0.421
  070868       0    0.00   0.421
  070869       0    0.00   0.421
  070870       0    0.00   0.421
  070871       0    0.00   0.421
  070872       0    0.00   0.421
  070873       0    0.00   0.421
  070874       0    0.00   0.421
  070875       0    0.00   0.421
  070876       0    0.00   0.421
  070877       0    0.00   0.421
  070878       0    0.00   0.421
  070879       0    0.00   0.421
  070880       0    0.00   0.421
  070881       0    0.00   0.421
  070882       0    0.00   0.421
  070883       0    0.00   0.421
     2       1     0.0
  0.000  7.7E-2     0.5
```

```
Loring silt loam; Hydrologic Group C;
  125.00     0.0   0   0   0   0   0   0   0   0   0
    0.0 4.21E-6    0.00
      3
      1   10.00   1.600   0.294   0.000   0.000
        0.0230  0.0230   0.000
          0.10   0.294   0.094   1.160    70.4
      2   10.00   1.600   0.294   0.000   0.000
        0.0230  0.0230   0.000
          2.00   0.294   0.094   1.160    70.4
      3  105.00   1.800   0.147   0.000   0.000
        0.0460  0.0460   0.000
           5.0   0.147   0.087   0.174    10.6
      0       0
         YEAR      5          YEAR      5          YEAR      5   1
      5   YEAR
    RFLX    TSER        1.0E+05
    EFLX    TSER        1.0E+05
    ESLS    TSER        1.0E+00
    RUNF    TSER        1.0E+00
    PRCP    TSER        1.0E+00
```

SITES/SCENARIOS FOR TOBACCO

This report describes the Tier II estimated environmental concentration (EEC) computer modelling for chlorpyrifos use on tobacco. The purpose of this analysis is to generate an aquatic exposure estimates for use in a refined ecological risk assessment for this chemical. It assumes one application at the maximum permitted label rate of 5.0 pounds per hectare. This Tier II EEC calculation uses a single site which represents a high exposure scenario for the use of Chlorpyrifos. It employs the standard scenario which represents a 10 hectare field draining into a 1 hectare pond, 2 m deep with no outlet. Inflow to the pond from runoff is assumed to be equal in magnitude to loss from evaporation.

The weather and agricultural practice are simulated at the site over 36 years so that the ten year exceedence probability EEC at that site can be estimated. The EEC's generated in this analysis were calculated using PRZM2 for simulating runoff from the agricultural field and EXAMS 2.94 for estimating environmental fate and transport in surface water.

The site is a tobacco field in Wake county, North Carolina in MLRA 133A. The soil at the site is a Norfolk loamy sand. Soil parameters were taken from the PIC database and the 1987 National Resources Inventory. The Norfolk loamy sand is hydrologic group B soil and SCS curve numbers were generated based on this grouping and the plant cover (United States Soil Conservation Service, 1972). The weather data file is part of the PIRANHA shell and is used to represent the weather for MLRA 133A. This is weather station W13895 in Montgomery, AL.

The parameters used in PRZM2 to describe the scenario are tabulated in Table 1 attached. The chemical and environment parameters used in the EXAMS program are tabulated in Table 2 also attached to this report. The site was selected to represent tobacco site in the south-eastern United States that would be likely to present high exposure to aquatic organisms.

Procedure

The PRZM simulation was run for a period of 36 years from 1948 to 1983 with application of the pesticide once per year at the label rate of 5.0 pounds per acre of active ingredient for each application. EXAMS loading (PRZM2EXA) files were developed to have 1% of each application rate applied to the pond as spray drift. EXAMS was run for all 36 years in mode 3. The yearly maxima, largest yearly peaks, maximum 96-hour means and largest yearly 21-day means were extracted from the REPORT.XMS file produced by EXAMS. The largest yearly 60- and 90-day means were calculated by PEO from daily concentration values generated by EXAMS. The 10 year return EEC's (or 10% yearly exceedence EEC's) show on the graphs and listed in the attached Tables were calculated by linear interpolation between the third and fourth largest values. Input files for these analyses are also attached to the end of this report.

Limitations of this Analysis

There are several factors which could limit the accuracy and precision of this analysis

including the selection of the high exposure scenarios, the quality of the input data, the ability of the models to represent the real world, and the number of years that were modeled.

Scenarios that are selected for use in Tier 2 EEC calculations are ones that likely to produce relatively high concentrations in the aquatic environment. Each scenario should represent a real site to which the pesticide in question is likely to be applied. Sites should be extreme enough to provide conservative estimates of the EEC, but not so extreme that the model cannot properly simulate the fate and transport processes at the site. Currently, sites are chosen by best professional judgement to represent sites which generally produce EEC's larger than 90% of all sites use for that crop. The EEC's in this analysis are accurate only to the extent that the site represents this hypothetical high exposure site. Another potentially limiting part of the site selection is the use of the standard pond with no outlet. A single pond with Georgia characteristics may not be a good representation of all water bodies in the state of North Carolina. It does, however, give a conservative estimate of an estimated environmental concentration (EEC) in a water body that serves as a surrogate for all sensitive water bodies and provides a level playing field on which most pesticides can be judged on equal terms.

The models themselves represent a limitation on the analysis quality. While the models are some of the best environmental fate estimation tools available, they have significant limitations in their ability to represent some processes. The most substantial limitation in this analysis is the handling of spray drift, which is estimated as a straight 1% of the application rate reaching the pond for each application. A second major limitation of the models is the lack of validation at the field level for pesticide runoff. While several of the algorithms (volume of runoff water, eroded sediment mass, are well validated and well understood, no adequate validation has yet been made of PRZM2 for the amount of pesticide transported in runoff events for all combinations of sites and pesticide fate characteristics. Other limitations of the models include: inability to handle within site variation (spatial variability), lack of crop growth algorithms, and overly simple soil water transport algorithms (ie. the "tipping bucket" method).

A final limitation is that only thirty-six years of weather data was available for the site. Consequently there is approximately 1 chance in 20 that the true 10% exceedence EEC's are larger than the maximum EEC in the calculated in the analysis.

```
*** PRZM2 Version 2.3 Data File ***
*** NCTOBACO.INP February 15, 1995 ***
*** Conventional tillage with crop residue left on the field after harvest***
Chlorpyrifos
Norfolk Loamy Sand; MLRA P-133A, Wake County, North Carolina, Tobacco
  0.770   0.150       0   27.50       1       1
     1
   0.24    0.33    1.00   10.00    6.20
     1
     1    0.20   45.00   80.00       3  86  78  82 .41 .41 .41    0.00
    36
```

110448 060748 160748 1
110449 060749 160749 1
110450 060750 160750 1
110451 060751 160751 1
110452 060752 160752 1
110453 060753 160753 1
110454 060754 160754 1
110455 060755 160755 1
110456 060756 160756 1
110457 060757 160757 1
110458 060758 160758 1
110459 060759 160759 1
110460 060760 160760 1
110461 060761 160761 1
110462 060762 160762 1
110463 060763 160763 1
110464 060764 160764 1
110465 060765 160765 1
110466 060766 160766 1
110467 060767 160767 1
110468 060768 160768 1
110469 060769 160769 1
110470 060770 160770 1
110471 060771 160771 1
110472 060772 160772 1
110473 060773 160773 1
110474 060774 160774 1
110475 060775 160775 1
110476 060776 160776 1
110477 060777 160777 1
110478 060778 160778 1
110479 060779 160779 1
110480 060780 160780 1
110481 060781 160781 1
110482 060782 160782 1
110483 060783 160783 1
Application 1 broadcast @ 5.0 lb a.i/a, incorported to 2", 1% spray drift
36 1 0
Chlorpyrifos KOC=6070, AeSM T1/2= 76.933 (62.09) days, AnSM: T1/2=15 days
010448 0 5.08 5.335
010449 0 5.08 5.335
010450 0 5.08 5.335
010451 0 5.08 5.335
010452 0 5.08 5.335
010453 0 5.08 5.335

010454 0 5.08 5.335
010455 0 5.08 5.335
010456 0 5.08 5.335
010457 0 5.08 5.335
010458 0 5.08 5.335
010459 0 5.08 5.335
010460 0 5.08 5.335
010461 0 5.08 5.335
010462 0 5.08 5.335
010463 0 5.08 5.335
010464 0 5.08 5.335
010465 0 5.08 5.335
010466 0 5.08 5.335
010467 0 5.08 5.335
010468 0 5.08 5.335
010469 0 5.08 5.335
010470 0 5.08 5.335
010471 0 5.08 5.335
010472 0 5.08 5.335
010473 0 5.08 5.335
010474 0 5.08 5.335
010475 0 5.08 5.335
010476 0 5.08 5.335
010477 0 5.08 5.335
010478 0 5.08 5.335
010479 0 5.08 5.335
010480 0 5.08 5.335
010481 0 5.08 5.335
010482 0 5.08 5.335
010483 0 5.08 5.335
1 3 0.0
Norfolk Loamy Sand; Hydrologic Group B;
150.00 0.0 0 0 0 0 0 0 0 0 0
0.0 1.49E-7 0.00
4
1 10.00 1.550 0.199 0.000 0.000
9.01e-3 9.01e-3 0.000
0.1 0.199 0.089 0.290 17.6
2 35.00 1.550 0.199 0.000 0.000
9.01e-3 9.01e-3 0.000
5.0 0.199 0.089 0.290 17.6
3 55.00 1.300 0.406 0.000 0.000
0.0460 0.0460 0.000
5.0 0.406 0.206 0.116 7.04
4 50.00 1.100 0.396 0.000 0.000

```
    0.0460  0.0460   0.000
      5.0   0.396   0.246   0.058    3.52
  0       0
     YEAR      5          YEAR      5          YEAR      5  1
  5

RFLX    TSER         1.0E+05
EFLX    TSER         1.0E+05
ESLS    TSER         1.0E+00
RUNF    TSER         1.0E+00
PRCP    TSER         1.0E+00
```

SITES/SCENARIOS FOR CITRUS

This report describes the Tier II estimated environmental concentration (EEC) computer modelling for chlorpyrifos use on citrus trees. The purpose of this analysis is to generate aquatic exposure estimates for use in a refined ecological risk assessment for this chemical. This Tier II EEC calculation uses a single citrus site which represents a high exposure scenario for the use of chlorpyrifos on citrus trees. It uses the standard scenario which represents a 10 hectare field draining into a 1 hectare pond, 2 meters deep with no outlet. Evaporation from the pond is considered to be equal in magnitude to inflow into the pond from surface runoff. The site is located in central Florida and would be expected to produce moderate runoff due to relatively high rainfall but sandy soil. Soil erosion is expected to be low due also to the very sandy nature of the area. Air blast spray application is simulated.

The weather and agricultural practices are modelled at the site over 36 years so that the ten year exceedence probability EEC at that site can be estimated. The Tier 2 upper tenth percentile EEC's are graphed and listed below. The EEC's have been calculated so that in any given year, there is a 10% probability that the maximum of the average concentrations for each duration in that year will equal or exceed the EEC at the site. Durations for which average concentrations are calculated are those which correspond to the length of relevant toxicity tests.

The EEC's generated in this analysis were calculated using PRZM2 for simulating runoff from the agricultural field and EXAMS 2.94 for estimating environmental fate and transport in surface water. The parameters used in PRZM2 to describe the scenario are tabulated in Table 1 attached. The chemical and environment parameters used in the EXAMS program are tabulated in Table 2 also attached to this report. Copies of the PRZM2 input files are also attached.

The site is an orange grove in Osceola County, Florida in MLRA 156A. The soil at the site is an Adamsville Sand. Soil parameters were taken from the PIC database and the 1987 National Resources Inventory. The Adamsville sand is hydrologic group C soil and SCS curve numbers were generated based on this grouping and the plant cover (United States Soil Conservation Service, 1972). The weather data file is part of the PIRANHA shell and is used to represent the weather for MLRA 156A. This site receives about 93 cm of precipitation yearly. An average of 19% of this leaves the site as surface runoff.

Procedure

The PRZM simulation was run for a period of 36 years from 1948 to 1983 with application of the pesticide two times per year. EXAMS loading (PRZM2EXA) files were developed to have 5% of each application rate applied to the pond as spray drift. EXAMS was run for all 36 years in mode 3. The yearly maximums, largest yearly peaks, maximum 96-hour means and largest yearly 21-day means were extracted from the REPORT.XMS file produced by EXAMS. The largest yearly 60- and 90-day means were calculated by the PEO program from daily concentration values generated by EXAMS. The 10 year return EEC's (or 10% yearly exceedence EEC's) are shown on attached graphs and are listed in attached tables. They were calculated by linear interpolation between the third and fourth largest values.

Limitations of this Analysis

There are several factors which may limit the accuracy and precision of this analysis including the selection of the high exposure scenarios, the quality of the input data, the ability of the models to represent the real world, and the number of years that were modeled.

Scenarios that are selected for use in Tier 2 EEC calculations are ones that likely to produce large concentrations in the aquatic environment. Each scenario should represent a real site to which the pesticide in question is likely to be applied. Sites should be extreme enough to provide conservative estimates of the EEC, but not so extreme that the model cannot properly simulate the fate and transport processes at the site. Currently, sites are chosen by best professional judgement to represent sites which generally produce EEC's larger than 90% of all sites use for that crop. The EEC's in this analysis are accurate to the extent that the site represents this hypothetical high exposure site. Another limiting part of the site selection is the use of the standard pond. Obviously, a Georgia pond, even with appropriately modified temperature data may not be the most appropriate water body for use in Florida. It does however provide a level playing field on which most pesticides can be judged on equal terms.

The models themselves may also represent a limitation on the accuracy of the analysis. While the models are some of the best environmental fate estimation tools available, they have significant limitations in their ability to represent some processes. The most substantial limitation in this analysis is the handling of spray drift, which is estimated as a straight 5% of the application rate reaching the pond for each application. A second major limitation of the models is the lack of validation at the field level for pesticide runoff. While several of the algorithms (volume of runoff water, eroded sediment mass, are well validated and well understood, no adequate validation has yet been made of PRZM2 for the amount of pesticide transported in runoff events for all combinations of sites and pesticide fate characteristics. Other limitations of the models include: inability to handle within site variation (spatial variability), lack of crop growth algorithms, and overly simple soil water transport algorithms (ie. the "tipping bucket" method).

A final limitation is that only thirty-six years of weather data was available for the site. Consequently there is approximately 1 chance in 20 that the true 10% exceedence EEC's are larger than the maximum EEC in the calculated in the analysis.

```
*** PRZM2 Version 2.3 Input Data File ***
*** FLCITRUS.INP March 5, 1995 ***
*** Assume bare soil underneath the trees for heating ***
Chlorpyrifos
Adamsville Sand; MLRA U-156A, Osceola County, FL
  0.770   0.150       0   25.00       1       1
     1
   0.10    0.13    1.00   10.00    6.20
     1
     1    0.10  100.00   80.00       3  94  84  89 .30 .30 .30    0.00
```

```
    36
  110548  170748  010848      1
  110549  170749  010849      1
  110550  170750  010850      1
  110551  170751  010851      1
  110552  170752  010852      1
  110553  170753  010853      1
  110554  170754  010854      1
  110555  170755  010855      1
  110556  170756  010856      1
  110557  170757  010857      1
  110558  170758  010858      1
  110559  170759  010859      1
  110560  170760  010860      1
  110561  170761  010861      1
  110562  170762  010862      1
  110563  170763  010863      1
  110564  170764  010864      1
  110565  170765  010865      1
  110566  170766  010866      1
  110567  170767  010867      1
  110568  170768  010868      1
  110569  170769  010869      1
  110570  170770  010870      1
  110571  170771  010871      1
  110572  170772  010872      1
  110573  170773  010873      1
  110574  170774  010874      1
  110575  170775  010875      1
  110576  170776  010876      1
  110577  170777  010877      1
  110578  170778  010878      1
  110579  170779  010879      1
  110580  170780  010880      1
  110581  170781  010881      1
  110582  170782  010882      1
  110583  170783  010883      1
Application schedule: 2 aerial @ 3.5 lb a.i/a, 75% appl eff, 5 % spray drift
    72      1      0
Chlorpyrifos Koc:6070 AeSM: T1/2=76.93 (62.09) days, AnSM: T1/2=15 days
  010748      0    0.0  2.948
  010848      0    0.0  2.948
  010749      0    0.0  2.948
  010849      0    0.0  2.948
```

010750	0	0.0	2.948
010850	0	0.0	2.948
010751	0	0.0	2.948
010851	0	0.0	2.948
010752	0	0.0	2.948
010852	0	0.0	2.948
010753	0	0.0	2.948
010853	0	0.0	2.948
010754	0	0.0	2.948
010854	0	0.0	2.948
010755	0	0.0	2.948
010855	0	0.0	2.948
010756	0	0.0	2.948
010856	0	0.0	2.948
010757	0	0.0	2.948
010857	0	0.0	2.948
010758	0	0.0	2.948
010858	0	0.0	2.948
010759	0	0.0	2.948
010859	0	0.0	2.948
010760	0	0.0	2.948
010860	0	0.0	2.948
010761	0	0.0	2.948
010861	0	0.0	2.948
010762	0	0.0	2.948
010862	0	0.0	2.948
010763	0	0.0	2.948
010863	0	0.0	2.948
010764	0	0.0	2.948
010864	0	0.0	2.948
010765	0	0.0	2.948
010865	0	0.0	2.948
010766	0	0.0	2.948
010866	0	0.0	2.948
010767	0	0.0	2.948
010867	0	0.0	2.948
010768	0	0.0	2.948
010868	0	0.0	2.948
010769	0	0.0	2.948
010869	0	0.0	2.948
010770	0	0.0	2.948
010870	0	0.0	2.948
010771	0	0.0	2.948
010871	0	0.0	2.948
010772	0	0.0	2.948

```
 010872       0     0.0   2.948
 010773       0     0.0   2.948
 010873       0     0.0   2.948
 010774       0     0.0   2.948
 010874       0     0.0   2.948
 010775       0     0.0   2.948
 010875       0     0.0   2.948
 010776       0     0.0   2.948
 010876       0     0.0   2.948
 010777       0     0.0   2.948
 010877       0     0.0   2.948
 010778       0     0.0   2.948
 010878       0     0.0   2.948
 010779       0     0.0   2.948
 010879       0     0.0   2.948
 010780       0     0.0   2.948
 010880       0     0.0   2.948
 010781       0     0.0   2.948
 010881       0     0.0   2.948
 010782       0     0.0   2.948
 010882       0     0.0   2.948
 010783       0     0.0   2.948
 010883       0     0.0   2.948
    2       3     0.0
   0.0   0.289     0.5
Adamsville Sand; Hydrologic Group C;
  100.00     0.0   0   0   0   0   0   0   0   0   0
    0.0 4.21E-6     0.00
      3
     1   10.00   1.440   0.086   0.000   0.000
       9.01E-3 9.01E-3   0.000
          0.1   0.086   0.036   0.580    35.2
     2   10.00   1.440   0.086   0.000   0.000
       9.01E-3 9.01E-3   0.000
          1.0   0.086   0.036   0.580    35.2
     3   80.00   1.580   0.030   0.000   0.000
        0.0460  0.0460   0.000
          5.0   0.030   0.023   0.116    7.04
     0       0
         YEAR      5          YEAR      5          YEAR      5   1
     5    YEAR
   RFLX    TSER        1.0E+05
   EFLX    TSER        1.0E+05
   ESLS    TSER        1.0E+00
   RUNF    TSER        1.0E+00
```

PRCP TSER 1.0E+00

GENEEC Model (Examples)

No. 1. CHLORPYRIFOS (1 Aerial Broadcast Spray Application)

RATE (#/AC) ONE(MULT)	APPLICATIONS NO.-INTERVAL	SOIL KOC	SOLUBILITY (PPM)	% SPRAY DRIFT	INCORP. DEPTH (IN)
2.000(2.000)	1 1	6070.0	2.0	5.0	0

FIELD AND STANDARD POND HALFLIFE VALUES (DAYS)

METABOLIC (FIELD)	DAYS UNTIL RAIN/RUNOFF	HYDROLYSIS (POND)	PHOTOLYSIS (POND-EFF)	METABOLIC (POND)	COMBINED (POND)
180.00	2	N/A	29.60- 3631.92	.00	3631.92

GENERIC EECs (IN PPB)

PEAK GEEC	AVERAGE 4 DAY GEEC	AVERAGE 21 DAY GEEC	AVERAGE 56 DAY GEEC
10.30	9.19	5.19	3.23

No. 2. CHLORPYRIFOS (1 Ground Broadcast Spray Application)

RATE (#/AC) ONE(MULT)	APPLICATIONS NO.-INTERVAL	SOIL KOC	SOLUBILITY (PPM)	% SPRAY DRIFT	INCORP. DEPTH (IN)
2.000(2.000)	1 1	6070.0	2.0	1.0	0

FIELD AND STANDARD POND HALFLIFE VALUES (DAYS)

METABOLIC (FIELD)	DAYS UNTIL RAIN/RUNOFF	HYDROLYSIS (POND)	PHOTOLYSIS (POND-EFF)	METABOLIC (POND)	COMBINED (POND)
180.00	2	N/A	29.60- 3631.92	.00	3631.92

GENERIC EECs (IN PPB)

PEAK GEEC	AVERAGE 4 DAY GEEC	AVERAGE 21 DAY GEEC	AVERAGE 56 DAY GEEC
7.37	6.46	3.72	2.40

No. 3. CHLORPYRIFOS (1 Ground Soil Incorporated Spray Application)

RATE (#/AC) ONE(MULT)	APPLICATIONS NO.-INTERVAL	SOIL KOC	SOLUBILITY (PPM)	% SPRAY DRIFT	INCORP. DEPTH (IN)
2.000(2.000)	1 1	6070.0	2.0	1.0	1.5

FIELD AND STANDARD POND HALFLIFE VALUES (DAYS)

METABOLIC	DAYS UNTIL	HYDROLYSIS	PHOTOLYSIS	METABOLIC	COMBINED

(FIELD)	RAIN/RUNOFF	(POND)	(POND-EFF)	(POND)	(POND)
180.00	2	N/A	29.60- 3631.92	.00	3631.92

GENERIC EECs (IN PPB)

PEAK GEEC	AVERAGE 4 DAY GEEC	AVERAGE 21 DAY GEEC	AVERAGE 56 DAY GEEC
5.18	4.55	2.62	1.67

No. 4. CHLORPYRIFOS (3 Aerial Broadcast Spray Applications)

RATE (#/AC) ONE(MULT)	APPLICATIONS NO.-INTERVAL	SOIL KOC	SOLUBILITY (PPM)	% SPRAY DRIFT	INCORP. DEPTH (IN)
2.000(5.842)	3 7	6070.0	2.0	5.0	0

FIELD AND STANDARD POND HALFLIFE VALUES (DAYS)

METABOLIC (FIELD)	DAYS UNTIL RAIN/RUNOFF	HYDROLYSIS (POND)	PHOTOLYSIS (POND-EFF)	METABOLIC (POND)	COMBINED (POND)
180.00	0	N/A	29.60- 3631.92	.00	3631.92

GENERIC EECs (IN PPB)

PEAK GEEC	AVERAGE 4 DAY GEEC	AVERAGE 21 DAY GEEC	AVERAGE 56 DAY GEEC
33.48	29.93	16.61	10.10

No. 5. CHLORPYRIFOS (3 Ground Broadcast Spray Applications)

RATE (#/AC) ONE(MULT)	APPLICATIONS NO.-INTERVAL	SOIL KOC	SOLUBILITY (PPM)	% SPRAY DRIFT	INCORP. DEPTH (IN)
2.000(5.842)	3 7	6070.0	2.0	1.0	0

FIELD AND STANDARD POND HALFLIFE VALUES (DAYS)

METABOLIC (FIELD)	DAYS UNTIL RAIN/RUNOFF	HYDROLYSIS (POND)	PHOTOLYSIS (POND-EFF)	METABOLIC (POND)	COMBINED (POND)
180.00	0	N/A	29.60- 3631.92	.00	3631.92

GENERIC EECs (IN PPB)

PEAK GEEC	AVERAGE 4 DAY GEEC	AVERAGE 21 DAY GEEC	AVERAGE 56 DAY GEEC
22.34	19.60	11.22	7.17

APPENDIX IV.
Case No: 0100
Chemical No: 059101

ENVIRONMENTAL FATE DATA REQUIREMENTS FOR CHLORPYRIFOS

Data Requirement	Use Pattern[1]	Does EPA Have Data To Satisfy This Requirement? (Yes, No, or Partially)	Bibliographic Citation	Must Additional Data Be Submitted under FIFRA 3(c)(2)(B)?
§158.290 ENVIRONMENTAL FATE				
Degradation Studies-Lab:				
161-1 Hydrolysis	1,2,3,8,9,11	Yes	00155577	No
161-2 Photodegradation In Water	1,2,3	Yes	41747206	No
161-3 Photodegradation On Soil	1,2	Yes	43509201,42495403	No
161-4 Photodegradation In Air				
Metabolism Studies-Lab:				
162-1 Aerobic Soil	1,2,3,8,9,11	Yes	42144911,00025619 42144912	No
162-2 Anaerobic Soil	1,2,3	Yes	00025619	No
162-3 Anaerobic Aquatic	1,2,3	Yes	00025619	No
162-4 Aerobic Aquatic				
Mobility Studies:				
163-1 Leaching- Adsorption/Desorp.	1,2,3,8,9,11	Yes	00154723,00155636,42493901 00155637,40050401,41892801	No
163-2 Volatility (Lab)	1,8,9	Yes	41829006	No
163-3 Volatility (Field)				
Dissipation Studies-Field:				
164-1 Soil Dissipation	1,2,3,11	Yes	40395201,42874704,40059001, 42924802,42924801,42874703	No
164-2 Aquatic (Sediment)				
164-3 Forestry				
164-5 Soil, Long-term				
Accumulation Studies:				
165-3 Irrigated Crops				
165-4 In Fish	1,2,3	Yes	40056401	No
165-5 In Aquatic Non-Target Org.	1,2,3	Yes	42495405,42495406	No
Ground Water Studies:				
166-1 Ground Water Small Prosp.				

166-2	Ground Water Small Retro.			
Surface Water Studies:				
167-1	Field Runoff			
167-2	Surface Water Monitoring			
§158.440 Spray Drift:				
201-1	Droplet Size Spectrum	1,2,3	No	Yes[2]
202-1	Drift Field Evaluation	1,2,3	No	Yes[2]

Appendix V. Ecological Effects Data Requirements

Date: November, 1998
Case No: 0100
Chemical No: 0591001

PHASE V
DATA REQUIREMENTS FOR CHLORPYRIFOS
ECOLOGICAL EFFECTS BRANCH

Data Requirements	Composition[1]	Use Pattern[2]	Does EPA Have Data To Satisfy This Requirement? (Yes, No)	Bibliographic Citation (MRID)	Must Additional Data Be Submitted under FIFRA3(c)(2)(B)?
6 Basic Studies in Bold					
71-1(a) Acute Avian Oral, Quail/Duck	TGAI	ABCHIKLMO	yes	00160000 44585416	no
	Major Degradate	ABCK	yes	41829001	no
71-1(b) Acute Avian Oral, Quail/Duck	(TEP) Dursban ME 20 Lorsban 15 G		 yes yes	 41885201 44585416	 no no
71-2(a) Acute Avian Diet, Quail	TGAI	ABCHIKLMO	yes	00046955 00095123 40854703 44585401 00022923 44585403	no
	Major Degradate	ABCK	no		no
	(TEP) Dursban ME 20	ABCK	yes	41965502	 no
71-2(b) Acute Avian Diet, Duck	TGAI	ABCHIKLM	yes	00095007 40854702 00046954	no
	Major Degradate	ABCK	yes	41829002	no
	(TEP) Dursban ME 20	ABCK	 yes	 41965501	no
71-3 Wild Mammal Toxicity					
71-4(a) Avian Reproduction Quail	TGAI	ABCK	yes[5]	00046951 42144902	no
71-4(b) Avian Reproduction Duck	TGAI	ABCK	yes[3]	00046952 42144901	no

Date: November, 1998
Case No: 0100
Chemical No: 0591001

PHASE V
DATA REQUIREMENTS FOR CHLORPYRIFOS
ECOLOGICAL EFFECTS BRANCH

Data Requirements	Composition[1]	Use Pattern[2]	Does EPA Have Data To Satisfy This Requirement? (Yes, No)	Bibliographic Citation (MRID)	Must Additional Data Be Submitted under FIFRA3(c)(2)(B)?
71-5(a) Simulated Terrestrial Field Study	(TEP) Turf Pyrinex 4 E	C	yes	42144903	no
71-5(b) Actual Terrestrial Field Study	(TEP) Corn Lorsban 4 E Lorsban 15 G		no	43483101	no no
72-1(a) Acute Fish Toxicity Bluegill	TGAI	ABCHIKLM	yes	40098001 40840904 00155781 00095013	no
	Major Degradate	ABCK	yes	41829003	no
72-1(b) Acute Fish Toxicity Bluegill	(TEP) Dursban 6 Dursban 25 W Dursban 25 W Dursban 10 CR Dursban 10 CR	ABCK	 yes[5] yes[5] yes[5] yes yes	 00095321 00095298 00095296 00233438 41043903	yes[4] no no no no no
72-1(c) Acute Fish Toxicity Rainbow Trout	TGAI	ABCHIKLMO	yes	40098001 00155781 40840903 00095013	no
	Major Degradate	ABCK	yes	41829004	no
72-1(d) Acute Fish Toxicity Rainbow Trout	(TEP) Dursban 6	ABCK	 yes[7]	 00095297	yes[4] no
72-2(a) Acute Aquatic Invertebrate Toxicity	TGAI	ABCHIKLMO	yes	40840902 00102520	no
	Major Degradate	ABCK	yes	41829005	no
72-2(b) Acute Aquatic Invertebrate Toxicity	(TEP)	ABCK	no		yes[4]
72-3(a) Acute Estu/Mari Tox Fish	TGAI	ABCK	yes	40228401	no
	Major Degradate	ABCK	yes	42245901	no

Date: November, 1998
Case No: 0100
Chemical No: 0591001

PHASE V
DATA REQUIREMENTS FOR CHLORPYRIFOS
ECOLOGICAL EFFECTS BRANCH

Data Requirements	Composition[1]	Use Pattern[2]	Does EPA Have Data To Satisfy This Requirement? (Yes, No)	Bibliographic Citation (MRID)	Must Additional Data Be Submitted under FIFRA3(c)(2)(B)?
72-3(b) Acute Estu/Mari Tox Mollusk	TGAI	ABCK	yes	40228401	no
	Major Degradate	ABCK	yes	42245903	no
72-3(c) Acute Estu.Mari Tox Shrimp	TGAI	ABCK	yes	40228401 42144906	no
	Major Degradate	ABCK	yes	42245902	no
72-3(d) Acute Estu/Mari Tox Fish	(TEP)	ABCK	no		yes[4]
72-3(e) Acute Estu/Mari Tox Mollusk	(TEP)	ABCK	no		yes[4]
72-3(f) Acute Estu/Mari Tox Shrimp	(TEP)	ABCK	no		yes[4]
72-4(a) Early Life-Stage Fish Freshwater	TGAI	ABCK	yes[3]	00233438 41043903	no
Estuarine	TGAI	ABCK	yes[3]	00154718	no
72-4(b) Life-Cycle Aquatic Invertebrate Freshwater	TGAI	ABCK	yes[4]	41073401	no
Estuarine	TGAI	ABCK	no	42664901	yes
72-5 Life-Cycle Fish	TGAI	ABCK	yes[3]	42834401 00154721	no
72-6 Aquatic Org. Accumulation					
72-7(a) Simulated Aquatic Field Study					
72-7(b) Actual Aquatic Field Study					
122-1(a) Seed Germ./Seedling Emerg.	TGAI	ABCK	no		
122-1(b) Vegetative Vigor	TGAI	ABCK	no		
122-2 Aquatic Plant Growth	TGAI	ABCK	no	40228401	yes[6]
123-1(a) Seed Germ./Seedling Emerg.	TGAI	ABCK	no		
123-1(b) Vegetative Vigor	TGAI	ABCK	no		
123-2 Aquatic Plant Growth	TGAI	ABCK	yes	40228401	no[6]

Date: November, 1998
Case No: 0100
Chemical No: 0591001

PHASE V
DATA REQUIREMENTS FOR CHLORPYRIFOS
ECOLOGICAL EFFECTS BRANCH

Data Requirements	Composition[1]	Use Pattern[2]	Does EPA Have Data To Satisfy This Requirement? (Yes, No)	Bibliographic Citation (MRID)	Must Additional Data Be Submitted under FIFRA3(c)(2)(B)?
124-1 Terrestrial Field Study					
124-2 Aquatic Field Study					
141-1 Honey Bee Acute Contact	TGAI	ABCK	yes	05001991 00066220	no
141-2 Honey Bee Residue on Foliage	TEP Dursban 4 EC	ABCK	yes	00060632	no
141-5 Field Test for Pollinators	TEP Dursban 4 EC	ABCK	yes	00074486	no

[1] Composition: TGAI=Technical grade of the active ingredient; PAIRA+Pure active ingredient, radiolabeled; TEP=Typical end-use product

[2] Use Patterns: A=Terrestrial Food Crop; B=Terrestrial Feed Crop; C=Terrestrial Non-Food Crop; D=Aquatic Food Crop; E=Aquatic Non-Food Outdoor; F=Aquatic Non-Food Industrial; G=Aquatic Non-food Residential; H=Greenhouse Food Crop; I=Greenhouse Non-Food Crop; J=Forestry; K=Outdoor Recreation; L=Indoor Food; M=Indoor Non-Food; N=Indooor Medical; O=Indoor Residential; Z=Use Group for Site 00000

[3] The collection of studies together fulfill the test requirement.

[4] Testing was conducted by EPA and gives estimate of toxicity, but testing may not have been made under strict guideline conditions.

[5] Testing with TEP(s) is needed to evaluate those use patterns with aquatic exposure where the EEC $\geq$ LC50 or EC50 with TGAI.

[6] Aquatic plant testing is required for chlorpyrifos since it has outdoor non-residential terrestrial uses and may move off-site of application by drift (e.g., it has aerial and air blast applications). A Tier I test shows toxicity at application rates for *Skeletonema costatum*. Testing is required on the remaining four species: *Selenastrum capricornutum*, *Anabaena flos-aquae*, a freshwater diatom, and *Lemna gibba*.

Appendix VI. Comparison of Chlorpyrifos to Other High Risk Pesticide LOC's for Selected Crops based on Typical Use Rates

Selected Crops	Names of Pesticides per Crop	Max. Avian LD50 /ft^2 LOCs	Max. Avian LC50 LOCs	Max. Avian Repro. NOEL LOCs	Max. Fish LC50 LOCs	Max. Fish Repro. NOEC LOCs	Max. Aqua. Invert LC50 LOCs	Max. Invert Repro NOEC LOCs
Corn, Field	Carbofuran	471.3	1.8	....	1.5	0.8	11.0	33.4
	Phorate	257.4	0.8	37.7	25.8	14.8	84.5	15.8
	Chlorpyrifos	112.8	3.2	3.4	32.2	46.6	482.5	1215.2
	Ethyl Parathion	110.6	1.9	....	0.3	....	151.0	....
	Trichlorfon	23.5	1.0	76.5	1.0	....	1266.7	2.2
	Fonofos	11.9	35.2	....	6.3	7.1	22.7	119.6
	Methyl Parathion	8.4	5.1	68.1	0.6	0.0	253.0	41.2
	Malathion	2.9	0.2	....	4.8	2.0	38.6	....
	Terbufos	0.8	1.3	9.4	13.6	2.0	52.2	93.7
	Lindane	0.1	0.1	....	1.0	....	21.0	....
	Esfenvalerate	0.0	0.0	0.1	0.7	0.7	23.6	6.4
	Permethrin	0.0	0.0	0.2	0.5	0.9	574.7	16.4
Alfalfa	Carbofuran	471.3	1.8	....	1.5	0.8	11.0	35.4
	Methyl Parathion	?82.2	1.4	....	0.3	....	113.3	....
	Chlorpyrifos	37.6	1.1	1.1	10.6	15.4	159.8	402.2
	Malathion	7.3	0.1	....	2.2	0.9	17.2	....
	Dimethoate	5.8	0.2	12.1	0.0	....	0.5	514.3
	Phosmet	0.0	0.3	3.5	0.3	0.1	3.7	1.1
Peanuts	Fenamiphos	2018.0	9.5	181.3	7.3	....	43.8	....
	Phorate	584.0	1.7	85.6	35.2	20.1	115.2	21.4
	Ethoprophos	80.4	26.4	....	2.7	7.3	55.4	244.1
	Chlorpyrifos	75.0	2.1	2.2	21.5	31.0	321.8	808.7
	Fonofos	65.3	29.0	....	8.4	9.3	43.8	156.9
	Aldicarb	49.2	6.1	....	1.4	....	4.2	....
	Acephate	5.2	0.1	29.0	0.0	....	0.0	0.2
	Disulfoton	1.9	3.5	7.8	0.1	0.1	0.9	55.1
	Cyhalothrin-lam	0.0	0.0	0.0	5.7	....	6.9	....

Citrus (Oranges)	Fenamiphos	6072.1	10.1	....	1.7	....	5.7	....
	Chlorpyrifos	131.6	3.7	3.9	?37.5	54.3	562.8	1427.4
	Aldicarb	81.2	10.1	....	1.7	....	5.7	....
	Naled	0.4	0.2	....	0.2	1.8	129.4	137.8
Almonds	Diazinon	526.5	13.6	72.9	0.9	436.4	417.0	235.2
	Chlorpyrifos	75.2	2.1	2.2	21.5	31.0	321.3	808.7
	Azinphos-Methyl	3.7	0.8	27.8	70.0	10.0	251.2	9.2
	Phosmet	0.1	0.9	17.4	1.0	0.4	11.1	3.4
Apples	Diazinon	417.7	9.1	48.3	0.6	291.0	278.0	157.5
	Chlorpyrifos	112.8	3.2	3.4	32.2	46.6	482.5	1215.2
	Methomyl	17.8	0.1	6.5	0.1	0.3	41.4	39.0
	Oxamyl	6.1	1.3	5.8	0.0	0.1	14.8	0.0
	Endosulfan	5.6	0.7	3.7	415.8	110.8	935.5	8.2
	Azinphos-Methyl	2.7	0.4	20.7	52.5	7.5	189.0	6.9
	Phosmet	0.2	1.2	23.2	1.4	0.5	14.8	4.5
	Dicofol	0.1	4.4	16.8	0.0	0.0	0.0	0.0
	Carbaryl	0.0	0.1	1.2	0.3	0.1	48.8	9.2
Turf	Bendiocarb	510.7	1.3	15.8	0.3	0.1	20.9	....
	Chlorpyrifos	150.4	4.3	4.5	42.9	62.1	643.6	1619.3
	Acephate	26.9	0.8	145.0	0.0	....	0.1	....

[2] Because Chlorpyrifos is highly toxic to birds and fish and is applied both aerially and by airblast, the Spray Drift data requirements were imposed. These studies are being held in reserve pending the work currently being conducted by industry's Spray Drift Task Force, of which DowElanco, the registrant of Chlorpyrifos, is a member.